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Radio Spectrum Management Policy and Planning
Ministry of Business, Innovation and Employment
By email: Radio.Spectrum@mbie.govt.nz

Submission – 3.3 GHz Spectrum Use in New Zealand

KiwiRail welcomes the opportunity to submit on Radio Spectrum Management's (RSM) proposed spectrum plan for future use of radio frequencies between 3.30 and 3.41 GHz in New Zealand.

About KiwiRail

KiwiRail owns, operates and maintains New Zealand's national rail network, consisting of approximately 3,700 Km of mainline track spanning almost the full length of the country. KiwiRail is a State Owned Enterprise that provides the following services:

- Profitable and sustainable logistics services to freight markets.
- Inter-island shipping services to road, rail and passenger markets.
- An infrastructure division delivering asset management and improvements in the rail network.
- Commuter and tourism services.
- Property management and development.

Freight, tourism and commuter passenger rail services form a key part of New Zealand's economy and supply chain by supporting people, businesses, producers and exporters to contribute to national economic productivity as well as regional growth. Each week, the following volumes of scheduled train movements run on the national rail network:

- 900 freight trains
- 44 inter-city passenger trains
- 2,200 suburban passenger services in Wellington
- 3,700 suburban passenger services in Auckland

KiwiRail uses a variety of telecommunications technologies, including VHF radio, cellular telephony, fibre optic transmission systems and WiFi to provide safe operation of the rail network. However newer communications technologies (e.g. satellite, local wireless networks, IoT, digital radio) are expected to allow KiwiRail to address current challenges with communications 'holes' across the rail network (much of the network lies outside the coverage of public mobile networks).

These communications technologies, operating as an integrated backbone platform, will enable the implementation of future rail applications including:

- Signalling and automatic train protection safety systems

- Electronic track access authorities and permissions for train movements, maintenance vehicles and trackworker safety.
- Asset & freight tracking
- Asset condition monitoring for both infrastructure and rolling stock
- Passenger and customer real-time information provision

Potential Regional and National Use of the 3.3GHz Band in New Zealand

KiwiRail is developing its Future Communications Strategy and supporting business cases to take advantage of the opportunities provided by digital communications systems, so RSM's discussion document on potential regional and non-national use of the 3.3GHz spectrum band is well-timed.

Responses to the to the questions raised

Q1. Do you agree that the 10 MHz between 3.40 – 3.41 GHz should be included with the 3.4 - 3.8 GHz band (the 3.5 GHz band) that will be made available for national use?

KiwiRail does not use the 3.4 − 3.41 GHz frequency spectrum, therefore the proposed 10 MHz reallocation to extend the existing 3.41-3.8 GHz frequency band down to 3.4 GHz does not represent any conflict or concern with regards to any present or potential future usage of this spectrum.

Assuming the spectrum rationalisation taking place, the remaining 100 MHz frequency spectrum as part of the 3.3 − 3.4 GHz band would still have capability to accommodate potential use cases such as a coverage solution for a local area coverage, and fixed point to point, or point to multipoint links.

It is understood that this spectrum rationalisation is aligned with international developments, such as the European decisions that set out the technical conditions suitable for 5G and encourage the migration of other services out of the 3.4 - 3.8 GHz band. Therefore it would be anticipated that this spectrum rationalisation may offer further, benefit of scale, opportunities for the 3.3 − 3.4 GHz frequency band use in New Zealand due to European industry supply offering of networking equipment aimed at 3.3 − 3.4 GHz use.

Q2. What is your view on using the 3.3 - 3.4 GHz band for regional broadband and/or private networks? Are there other use cases of this band that should be considered?

KiwiRail is developing its own use cases for digital communications, and this process is at its early development stage. Once completed, this process is expected to inform KiwiRail's Digital Communications Roadmap and the Digital Strategy development. From the present day's perspective, without having fully identified all the possible KiwiRail's use case and scenarios, the Radio Spectrum Management identified specific use case of making the 3.3 − 3.4 GHz spectrum available for Private Networks use, aligns well with KiwiRail early considerations for the opportunities that the access to this spectrum may provide.

From KiwiRail's perspective, as an example only, being able to use this spectrum for large freight terminal business and operational applications connectivity or using the spectrum for fixed point-to-point and point-to-multipoint backhaul links would represent use cases, that are of interest for KiwiRail.

Q3. Do you agree with our assessment of current spectrum use and potential impacts?

KiwiRail has reviewed Radio Spectrum Management assessment of the current spectrum use and potential impacts. We agree with Radio Spectrum Management assessment that compatibility issues may arise if non-3GPP compliant equipment is permitted to operate in the 3.3 – 3.4 GHz frequency band. In our opinion, the potential compatibility issues would benefit from further assessment, therefore the use of the spectrum shall not be opened for non-3GPP compliant equipment, until this risk has been quantified, and a clear strategy has been established. In our opinion, Radio Spectrum Management is ideally placed to lead this assessment.

Q4. Do you agree with the assessment that regional and local use will not be able to co-exist in the same geographic area on the same frequency. If not, why?

We have the same view that the "regional use" and the "local use" in the same geographical area and using the same frequency spectrum allocation is likely to result in mutual interference.

As an example only, one of the potential KiwiRail use cases could be using this spectrum for point to point backhaul for the existing radio sites. Considering the good RF visibility that some of these sites have, there is a reasonable probability that another user's use of the same spectrum in the same geographical area may interfere with KiwiRail's usage or vice versa

Q5. Do you agree that both regional and indoor use as well as local and indoor use could be manageable in the same geographic area on the same frequency? If not, why?

Conceptually, both regional and indoor use, as well as local and indoor use could be manageable in the same geographical area and on the same frequency subject to there being sufficient isolation provided (e.g. propagation losses), and assuming that the transmitted power levels, receiver large interfering signal handling capability, etc. performance parameters are regulated to a common set of standards/ specifications.

In practice, the challenge will typically be in ensuring that sufficient isolation between services is provided. Reliance on the type of use / operating environment classification to provide sufficient isolation (e.g. "local" and "indoors") may not always achieve the expected result, due to a wide variety of environments and varying degrees of isolation that can be found in railway industry. This is unless an assessment is made on a case by case basis, which may not be practical for licensing reasons. As an example, a "local" coverage use for an underground railway station versus a "local" coverage use for at grade railway station with open platforms will result a different isolation performance.

Q6. Do you agree that the most effective way to manage spectrum in this band is to have contiguous services with a common frame structure and timing (synchronisation)? If not, why not?

Further consideration should be given to assessing the practicality of this approach, by taking into account variety of use cases intended for this spectrum, also how likely are different vendors to implement a common frame structure, and after all, the technical solution affordability.

Q7. What are your preferred options for a band plan for the 3.3 - 3.4 GHz band, are there other options we should consider, if so please explain what these are?

The scenarios 1 and 2 would appear as having potential to reduce mutual interference due to there being obvious separation through the use of a different frequency spectrum, and not having the complexity of multiple networks synchronisation for a common frame structure and timing. However, it is not clear how this would help to prevent interference between the users belonging to the same class if the isolation (e.g. propagation losses) may not be sufficient. Any spectrum segregation would also need to be tested against the supply industry offering to ensure any such segregation does not reduce the supply industry offering.

Q8. How much spectrum is required for regional and uses and how much is needed for local Use

There are multiple factors that would need to be considered and carefully balanced for determining spectrum allocation for the "regional use" versus "local use", for example, such as:

- Variety of use cases that may be specific / unique to the "regional use" versus "local use" (e.g. applications requiring high bandwidth, such as live CCTV footage, versus low bandwidth SCADA type applications);
- Different types of network topologies (e.g. a single site or a multiple sites network that may require more spectrum);
- The types of technology used that may itself dictate the minimum/ maximum size of a "channel" and how many "channels" may be required for a particular solution;
- Is the use harmonized to a common set of standards;
- The operating environment differences in terms of isolation (propagation losses) and how often the same spectrum could be re-used by another user belonging to the same class;
- The overall quantum of user base/ demand for "regional use" versus "local use".

Having the potential spectrum users sharing their known /potential use cases may assist making an informed decision.

From potential rail use cases perspective, most of the use cases could probably be categorised as "local use", for example:

- Coverage solution for a large freight terminal for critical business and operations applications;

- Coverage solution to locally interconnect rail condition monitoring system elements;
- Coverage solution for a railway station passenger infotainment systems.

Q9. What equipment options and standards should we consider for the 3.30 – 3.30 GHz band?

As the proposed frequency allocation aligns with the European allocation for the same spectrum, ensuring alignment to the same standards and equipment options, and spectrum use cases is likely to offer additional benefits of scale. It needs to be ensured that there is a competitive supply of industry offering for a compliant hardware solution.

Q10. If we adopt multiple standards how should we manage potential interference issues between the technologies while minimising inefficient use of spectrum?

By carefully assessing all the different types of intended uses being contemplated by the potential users, and reconfirming the priority uses for the spectrum, may allow narrowing down the intended/ allowed spectrum use to certain types of applications/ uses, that may assist ruling out certain standards applicability. For example, if the dominant majority of the intended use for this spectrum, as expressed by applicants, does not include the ETSI Digital Multipoint Radio System uses, then compliance with EN 302 326 could be ruled out.

Q11. Do you agree that we should seek to permit all three use cases, indoor, local and regional uses in the 3.3 GHz band? Do you agree with our mix of use? If not which cases should we permit?

From KiwiRail perspective, we have no objections to Radio Spectrum Management seeking permitting all three use cases, the "indoor", the "local" and the "regional" uses in the 3.3 – 3.4 GHz frequency band.

Conceptually, all mixes of use, as identified by Radio Spectrum Management, may be worth consideration, as long as the licensing framework ensures minimum interference outcome between the users. In practice (ref. Q7) the scenario 1 and 2 may be somewhat easier achievable.

Q12. What authorisation mechanisms should we use for indoor, local and regional use cases non-national access in the 3.3 – 3.4 GHz band? Are there any other mechanisms that should be considered?

The proposed "Interference Cooperation Mechanism" (as per 3.2.2 Local use) and authorisation based on "Technically Pre-planned Licenses" (as per 3.2.3 Regional use) appear to be well equipped for managing the interference risk.

The proposed authorisation mechanism based on the "Defined areas or block assignment" in our view needs further consideration, as it may not be particularly well suited for use cases where the spectrum is used to provide point-to-point, or point-to-multipoint solutions.

For example only, KiwiRail presently use data radio communications links to provide backhaul connectivity between the existing radio sites. Should the existing limited bandwidth solution be replaced with a 3.3 – 3.4 GHz solution, then in accordance with the "Defined areas or block assignment" licensing scheme, a license would need to be obtained

for the "blocks" at both end points, as well as for a large number of "blocks" in between the end points locations that these links span? This may reduce the affordability of the spectrum for this type of use, assuming that the above principle would apply.

Q13. What are sort of rules should be applied to the authorisation mechanisms to ensure compatibility and fair access?

There probably isn't a single formula for this. Consideration could be given to applying existing proven authorisation mechanisms, adjusting as necessary based on the lessons learnt from similar spectrum assignments for similar uses. The ensuing thorough assessment means that the intended uses will align with the uses that the spectrum is being made available for. Consideration could also be given to prioritising spectrum allocation for uses that provide a wider benefit for society versus a private use, in alignment with RSM's Public Policy spectrum reservations.

Q14. How should we prevent spectrum denial / hoarding/ speculating of licenses? Should we adopt one of the existing models that RSM already employs or what new model should we use in the 3.3 GHz band?

In our view, consideration could be given to taking into account any lessons learnt from the previous/ present use of the existing models that RSM already employs and making any necessary further refinements.

Consideration could also be given to implementing some mechanism of spectrum applications screening through requesting the applicants to provide documented evidence to demonstrate that the spectrum will be used for the intended purposes, such as approved business cases, project funding allocation confirmation, etc.

Concluding Remarks

KiwiRail is interested in the potential that RSM's proposals for the use of the 3.3GHz band may have for rail applications and would be pleased to work with RSM to explore these further as part of the development our Future Rail Communications Rail Strategy over the next year.. Please contact me if you would like clarification of any our responses to the consultation questions above.

Ngā mihi nui,

John Skilton

Programme Director: Future Rail Systems